

REMARKS

Claims 1-8, as amended, remain herein.

1. Claims 1-8 were rejected under 35 U.S.C. 112, second paragraph, as indefinite. The term "the carrier-composing material" was said to lack antecedent basis. The claims are amended to replace the indicated term with "said carrier," for which antecedent support appears in claim 1, line 2. (An obvious spelling error in claim 8 is corrected.) Accordingly, the rejection is moot.

2. Claims 1, 2, and 5-8 were rejected under 35 U.S.C. 102(b) as anticipated by WO 97/47864. This rejection is traversed. The cited publication U.S. counterpart is Patent No. 6,161,378.

WO 97/47864 discloses a NO_x catalyst for exhaust gases. The reference at page 19, third full paragraph, (cited by the Examiner) reads:

To the porous support of 100 wt%, it is preferable to include the rare earth metals of 5-30 wt %. To the porous support of 100 wt%, it is preferable to include Ti of 0.1-30 wt %, and to the porous support of 100 wt%, it is preferable to include Si of 0.6-5 wt % as silica.

There is no disclosure here why silica is added. However, the reference at page 66, lines 5-13 states:

In Embodiment Catalyst 100, in case where SiO_2 supported amount was varied the NO_x gas purification rate was measured. The catalyst preparation manner and the experimental manner were similarly [sic] to those of Embodiment Catalyst 100. The results are shown in Table 11. By supporting SiO_2 , the initial period NO_x gas purification rate is improved. Further, the support amount of SiO_2 , was 0.6 wt% - 5 wt%, NO_x gas purification rate after SO_2 poisoning can obtain 60%.

Silica thus has been added to improve the initial period NO_x gas purification rate. The Embodiment 100 catalyst manufacture is described on page 63; the catalyst support is cordierite. Table 9 (page 64) shows that for the Embodiment 100 catalyst, the first component added to the alumina washcoat is Ce, after which Sr and SiO_2 are added. This treatment is followed by both Rh and Pt and finally Mg. Thus, the silica of the Embodiment 100 catalyst is in the alumina washcoat added as a coating to the already-formed cordierite support.

The present invention, in contrast to the cited art, involves increasing the strength of the NO_x catalyst at high temperature. See the specification page 3, lines 15-29 reading:

In general, carrier-composing materials decrease their strengths when they are exposed to high temperatures together with an alkali metal-containing catalyst layer. However, when they contain a small amount of Si therein, their initial strength can be increased and, as a result, they can possess a strength necessary for catalyst carrier even if their strength is slightly decreased, for example, when they are exposed to high

temperatures with an alkali-containing catalyst layer. Such an effect brought about by the inclusion of Si is striking in catalyst-composing ceramic materials, particularly in ceramic materials wherein the particles of the major component contain no Si therein and the bonding between the particles is relatively weak, such as alumina, aluminum titanate and the like. It is because Si bond the particles at the boundaries or assists such bonding.

Applicants' silica is added to the material that forms the carrier; see the discussion above. The silica provides increased strength to the carrier support. WO 97/47864 has no teaching or suggestion of adding Si to a carrier before forming the carrier structure.

Accordingly, review and withdrawal of this rejection are requested.

3. Claims 1-5 were rejected under 35 U.S.C. 102(b) as anticipated by Freudenberg et al. US 5,153,153. This rejection is traversed.

Freudenberg et al. discloses sintered ceramic materials based on aluminum titanate where SiO_2 and MgO are added in the slip casting process. Although it is stated at col. 5, line 45, that the ceramic composition can be used as a catalyst support, no

examples are provided of any catalysts or the catalytic metals employed. Furthermore, the reference contains no discussion of NO_x catalysts and a problem arising at higher temperatures caused by reaction of the alkali metal with the carrier. Although Freudenberg et al. discusses in col. 3, lines 55-64, the addition of SiO₂ improves physical properties there is no suggestion in the reference that SiO₂ would help solve the problem of NO_x alkali metals deteriorating the carrier.

Table IV (4) shows various amounts of SiO₂; the table is described in col. 8, lines 25-37, where it is noted that SiO₂ is important to stability under oxidizing conditions and MgO is important to stability under reducing conditions. There is no recognition of SiO₂ having any ability to improve the catalytic activity of a NO_x catalyst where alkali metals are present.

In the rejection of claim 5, the Examiner notes MgO is disclosed in the reference, citing the Abstract. However, as pointed out above, MgO is needed to provide stability under reducing conditions. There is no recognition of combining MgO and SiO₂ to be able to improve the catalytic activity of a NO_x catalyst where alkali metals are present.

Accordingly, review and withdrawal of this rejection are requested.

4. Claims 1, 2, and 4-8 were rejected under 35 U.S.C. 102(e) as anticipated by Hori et al. US 6,555,081. This rejection is traversed.

Hori et al. '081 discloses a catalyst for use with a lean burn engine. The catalyst contains an alkali metal (see col. 5, lines 36 et seq.) for adsorbing the oxidized and activated NO_x, particularly NO₂. The addition of silicon oxides is discussed at col. 3, lines 37-53 as follows:

i) The refractory inorganic oxide to be used for carrying platinum partly or wholly thereon may be any of the refractory inorganic oxides which are generally adopted as the carrier for a catalyst with the exception of cerium oxide. As concrete examples of such refractory inorganic oxides, there may be cited, for example, α -alumina, γ , δ , η , and θ active alumina, titania, or zirconia; silicon oxide, and complex oxides thereof such as, alumina-titania, alumina-zirconia, titania-zirconia etc. The oxides and complex oxides of aluminum, zirconium, titanium, and silicon, mixtures thereof, are preferably used and active alumina is used especially. When platinum is carried partly on the refractory inorganic oxide, the weight of the refractory inorganic oxide not containing platinum may be up to 20% by weight based on the weight of the refractory inorganic oxide containing platinum.

The silicon oxide is in the reference catalyst layer as a support for Pt. Hori et al. '081 provides no awareness of any ability of SiO_2 to improve the catalytic activity of a NO_x catalyst where alkali metals are present.

The Examiner cites Example 4 showing 5% silica. However, Example 7 contains a very large amount of silicon oxide (100 g), which appears to function as a replacement for the active alumina in Example 4. Given the use of these different amounts of silicon oxide, Hori et al. '081 does not or suggest to teach the artisan selecting only a low amount of silicon oxide as presently claimed to avoid the alkali metal deteriorating the carrier in a NO_x catalyst. Furthermore, the silicon oxide is a part of the catalyst layer that is coated on the carrier. See Example 1 where the catalyst coating is applied to a commercially-available cordierite honeycomb substrate (i.e., the carrier). The silicon oxide is not contained in the carrier-forming materials used to make the carrier.

Accordingly, review and withdrawal of this rejection are requested.

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Applicants respectfully submit that the present application is now in condition for allowance. Accordingly, the Examiner is requested to issue a Notice of Allowance for all pending claims.

Should the Examiner deem that any further action by the applicants would be desirable for placing this application in even better condition for issue, the Examiner is requested to telephone applicants' undersigned representative at the number listed below.

Respectfully submitted,

PARKHURST & WENDEL, L.L.P.

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Date


Charles A. Wendel
Registration No. 24,453

CAW/EC/ch
Attorney Docket No. WATK:212
PARKHURST & WENDEL, L.L.P.
1421 Prince Street, Suite 210
Alexandria, Virginia 22314-2805
Telephone: (703) 739-0220